AHMEDEL-SOHEMY, PhD
Professor & Associate Chair
Department of Nutritional Sciences
Faculty of Medicine
University of Toronto

Founder & Chief Science Officer
NUTRIGENOMIX®

Precision Nutrition:
Recent Advances and Controversies in Genetic testing for personalized nutrition

Disclosures

A.E-S. is the Founder and holds shares in Nutrigenomix Inc.

Learning Objectives

After the presentation, attendees should be able to:

- Understand how genetic variation impacts nutritional requirements.
- Learn how to identify relevant genetic markers with clinical relevance.
- Recognize the benefits and limitations of consumer genetic testing.
- Understand what genetic tests can and cannot reveal about a person’s health and dietary recommendations.

The Science of NUTRIGENOMICS

using genetic testing to determine why individuals respond differently to the same foods, beverages and supplements they consume.

2008

Physiol Genomics 33: 355–360, 2008.
First published March 18, 2008; doi:10.1152/physiolgenomics.00148.2007.

Genetic variant in the glucose transporter type 2 is associated with higher intakes of sugars in two distinct populations

Karen M. Eny,[1] Thomas M. S. Wolever,[1,2] Bénédicte Fontaine-Bisson,[1] and Ahmed El-Sohemy[1]
[1]*Department of Nutritional Sciences, University of Toronto; and* [2]*St. Michael's Hospital, Toronto, Canada*

Submitted 10 July 2007; accepted in final form 14 March 2008

2008

Craving something sweet? Blame it on your DNA

JOSEPH HALL
HEALTH REPORTER

If you have a sweet tooth, it won't be found amongst your molars or canines. It's inserted in your DNA instead.

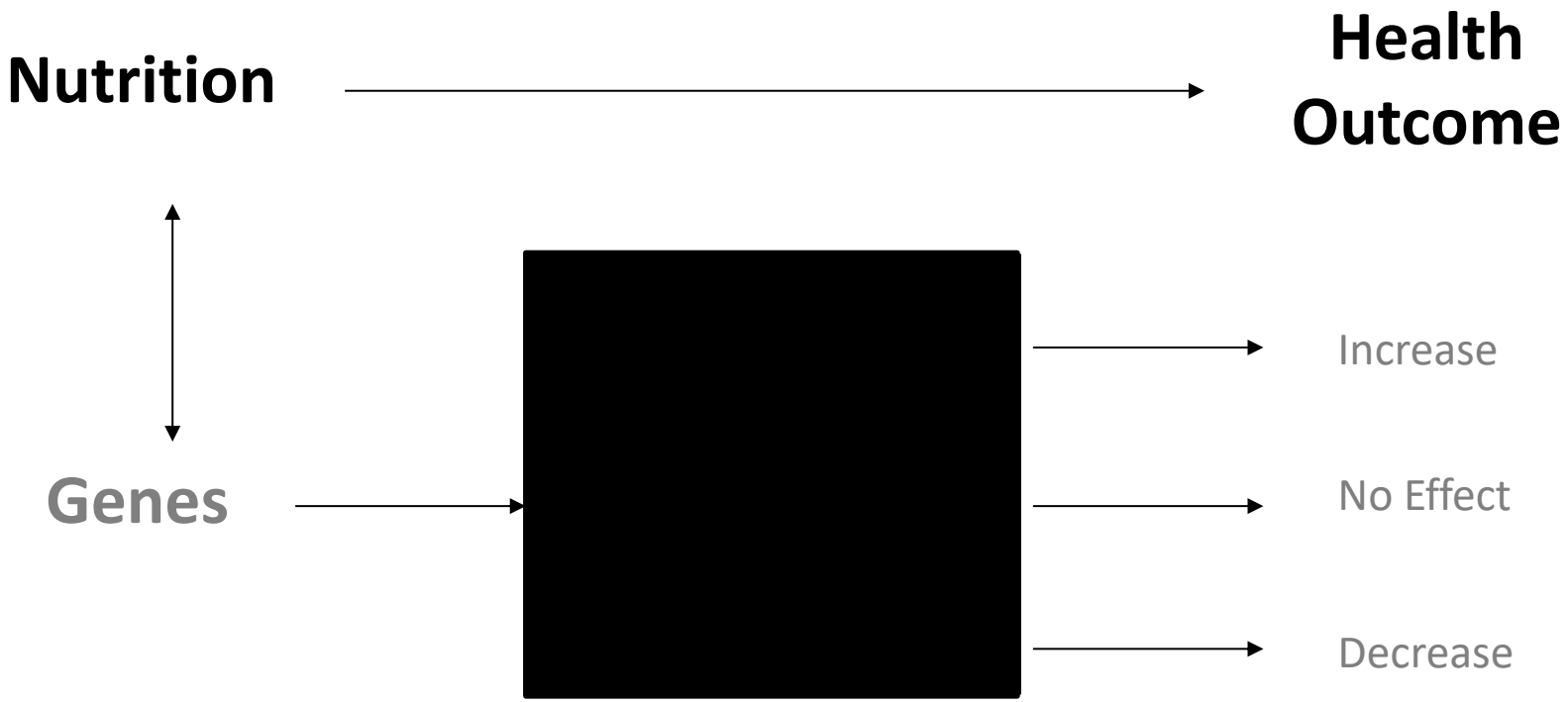
Cake and cola and cookie lovers may well be able to blame their cravings on a common variant of a gene that controls the brain's ability to sense sugars in the body, a new University of Toronto study suggests. About one in five people has the variant.

The gene may also have implications for a person's risk of getting diabetes.

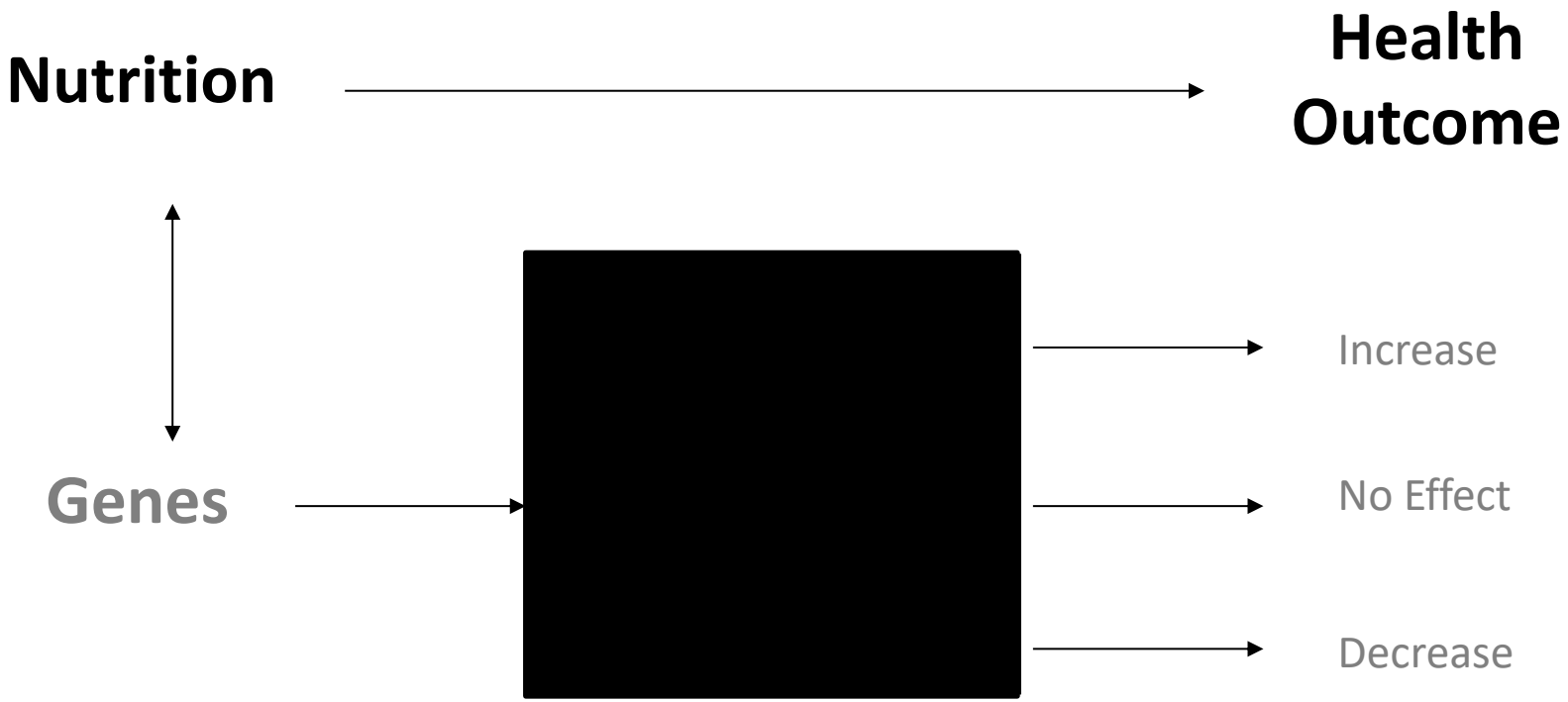
"In humans this gene functions as a glucose sensor in the brain to regulate appetite or food intake," says U of T nutrition expert

SUGAR continued on A17

The Science of Nutrigenomics



The Science of Nutrigenomics

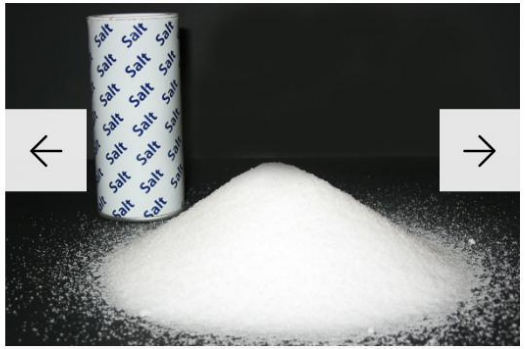


Categories: Scientific Conferences & Meetings, Heart News, Stroke News & Brain Health | **Published: November 11, 2023**

Reducing sodium intake significantly lowered blood pressure in as little as one week

American Heart Association Scientific Sessions 2023, Late-Breaking Science Abstract in LBS.04

Related Images



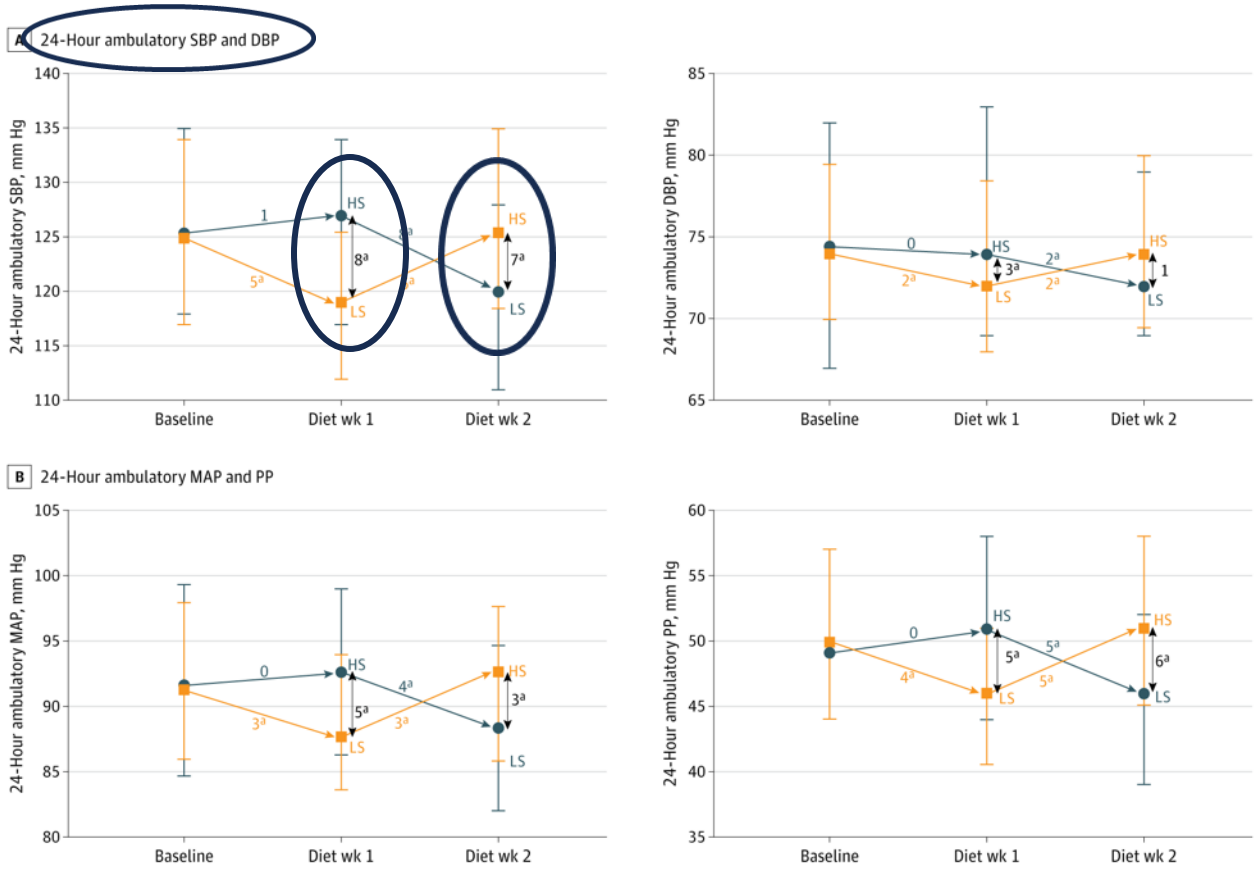
Salt

Pile of salt.

Download (888.2 kB)

From: **Effect of Dietary Sodium on Blood Pressure: A Crossover Trial**

JAMA. Published online November 11, 2023. doi:10.1001/jama.2023.23651



From: **Effect of Dietary Sodium on Blood Pressure: A Crossover Trial**

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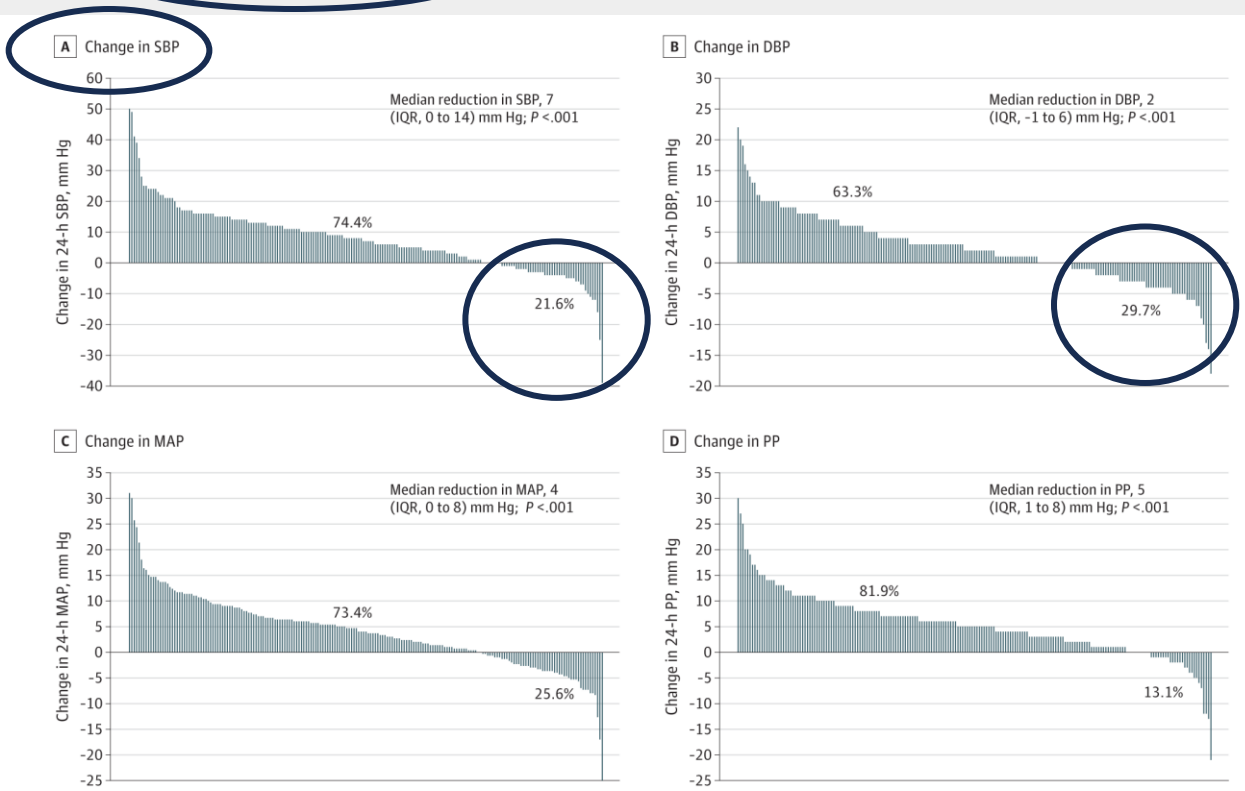
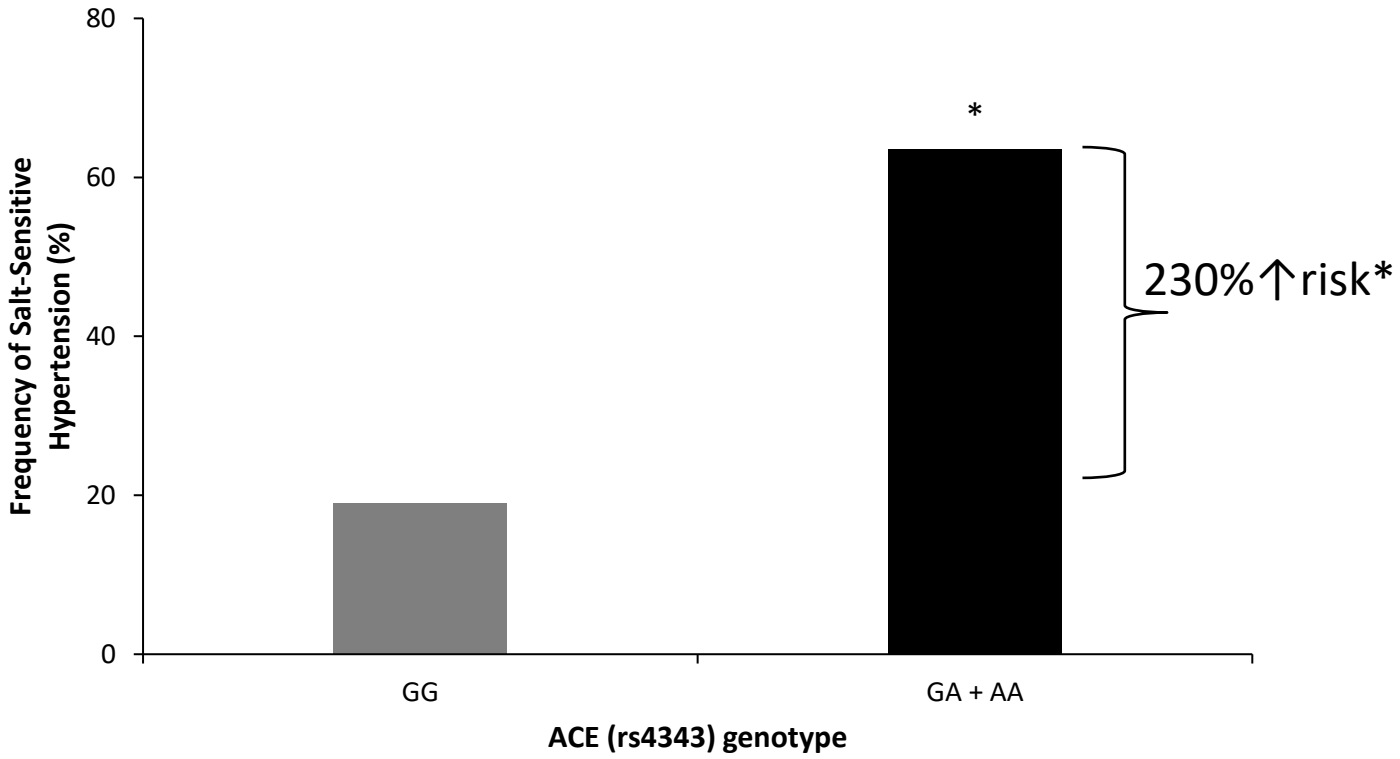


Figure Legend:

Distributions of Within-Individual 24-Hour Ambulatory BP Response to Dietary Sodium Intake, Calculated From High-Sodium Diet Minus Low-Sodium DietBP indicates blood pressure; DBP, diastolic blood pressure; MAP, mean arterial pressure; PP, pulse pressure; and SBP, systolic blood pressure. Bars above 0 reflect a reduction in BP during low-sodium diet vs high-sodium diet; bars below 0 reflect an increase in BP during low-sodium diet vs high-sodium diet. Percentages above 0 reflect proportion of individuals who experienced a reduction in BP during low-sodium diet vs high-sodium diet; percentages below 0 reflect proportion of individuals who experienced an increase in BP during low-sodium diet vs high-sodium diet. P values based on Wilcoxon signed rank test.

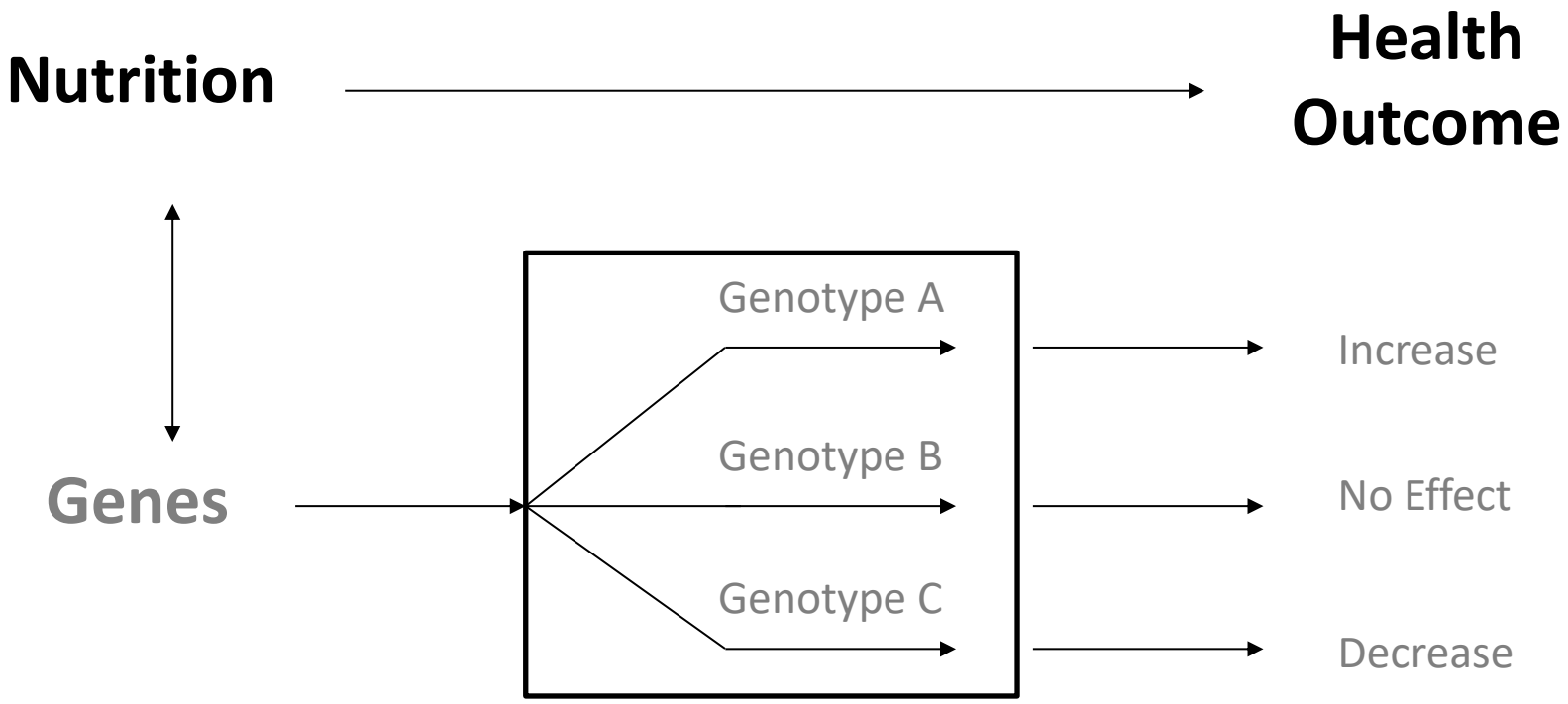
Prevalence of salt-sensitive hypertension by *ACE* genotype



* Relative risk of salt-sensitive hypertension with the GA or AA genotype compared to the GG genotype.

Adapted from Poch et al. Hypertension. 2001;38:1204-1209.

The Science of Nutrigenomics

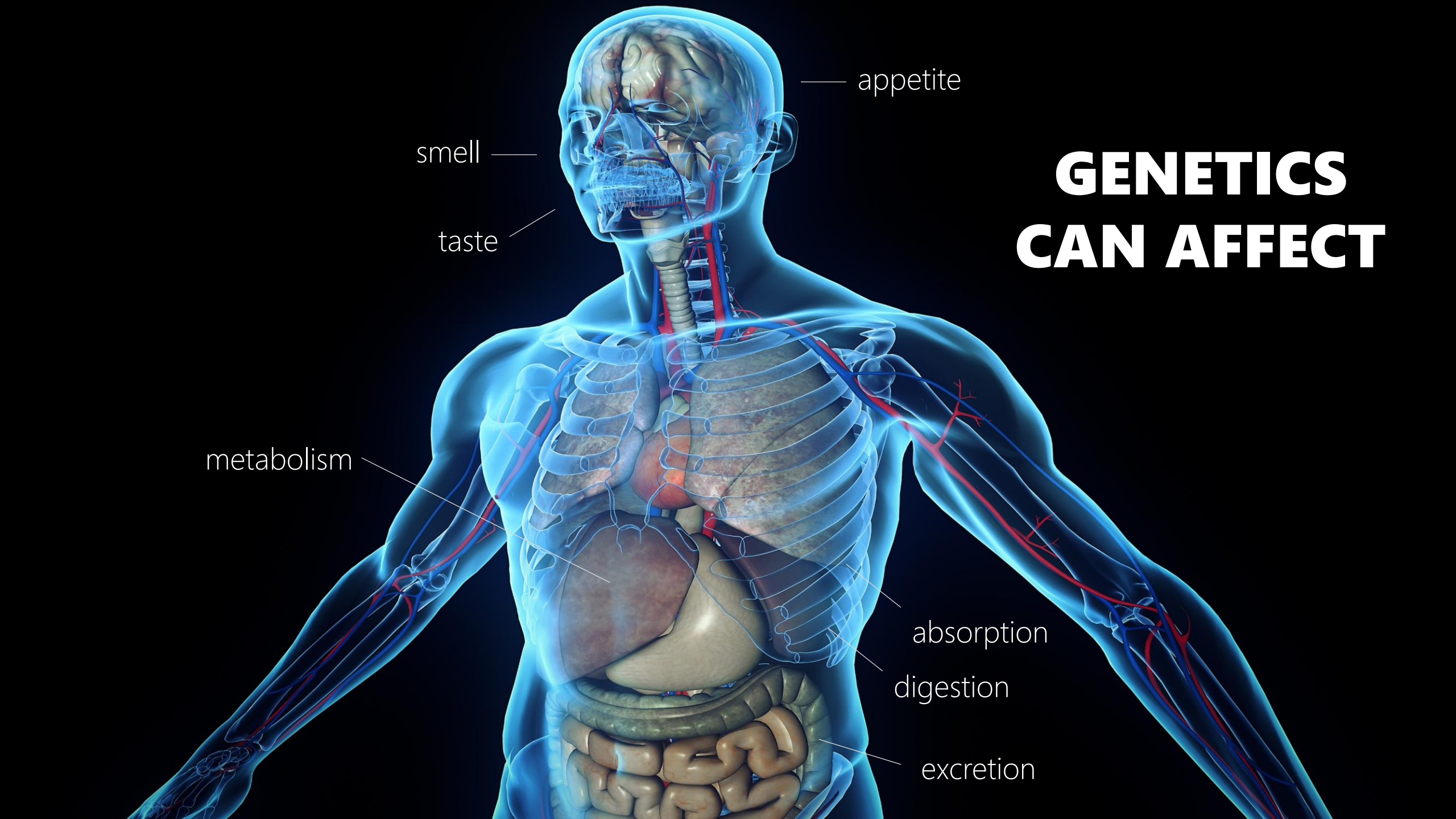


One size does not fit all


One man's food is another man's poison
- Lucretius (99-55 BC)

Human Genetic Variation

Common Genetic Variants



GENETICS CAN AFFECT

2007

Genetics may define diets of the future

Scientists look at how personalized nutrition could change how and what we eat

By Carrie Peyton Dahlberg
BEE STAFF WRITER

Deep in each person's genetic code may lie the answers to which medicines can help them, which environmental toxins can kill them, and even which foods they should eat to live well.

The tantalizing prospect of personally tailored diets, dictated by our genetic makeup, drew hundreds of scientists and dietitians from around the world to UC Davis over the weekend for a conference on nutritional genomics.

The fast-growing field "will be huge," said Jim Kaput, who next month will take over as head of the U.S. Food and Drug Administration's division of personalized nutrition and medicine. "We are definitely not ready for it."

In interviews, Kaput and other con-

▶ GENETICS, Page A10

NEWBORN SCREENING **ONTARIO**
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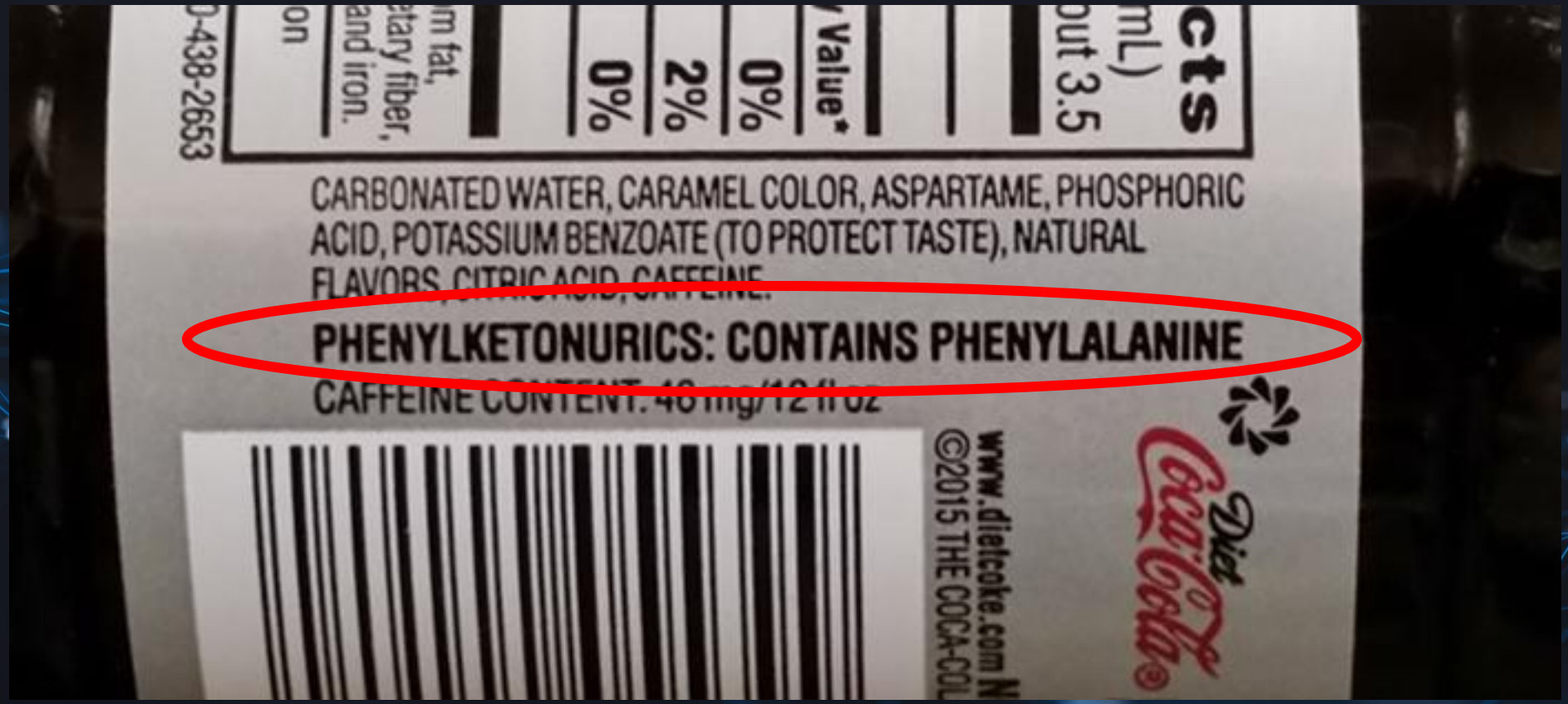
NEWBORN SCREENING ONTARIO
DÉPISTAGE NÉONATAL ONTARIO

26 diseases tested

70% are managed by diet

Argininosuccinic Acid Lyase Deficiency (ASA)
Biotinidase Deficiency
Carnitine Uptake Defect (CUD)
Citrullinemia
Cobalamin A & B Defects
Congenital Adrenal Hyperplasia (CAH)
Congenital Hypothyroidism (CH)
Critical Congenital Heart Disease (CCHD)
Cystic Fibrosis (CF)
Galactosemia
Glutaric Acidemia Type 1 (GA1)
Homocystinuria
Isovaleric Acidemia (IVA)
Long Chain 3-Hydroxyacyl-CoA Dehydrogenase Deficiency (LCHAD)
Maple Syrup Urine Disease (MSUD)
Medium Chain Acyl CoA Dehydrogenase Deficiency (MCADD)
Methylmalonic Acidemia (MMA)
Phenylketonuria (PKU)
Propionic Acidemia (PA)
Severe Combined Immune Deficiency (SCID)
Sickle Cell Disease (Hemoglobin SC)
Sickle Cell Disease (Hemoglobin SS)
Sickle Cell Disease (Sickle/Beta-Thalassemia)
Trifunctional Protein Deficiency (TFP)
Tyrosinemia Type 1
Very Long Chain Acyl CoA Dehydrogenase Deficiency (VLCAD)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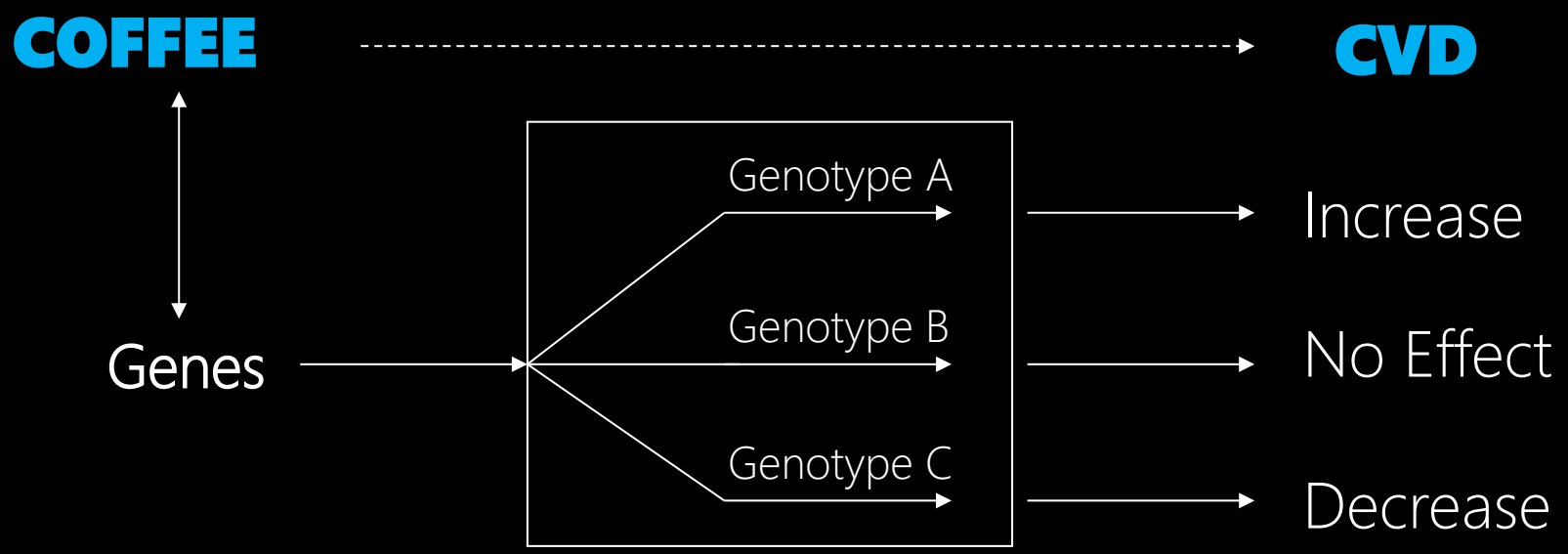
ORGANIC VALLEY
LACTOSE FREE
USDA ORGANIC
Lactose Free
QUART (946 mL)
Lactose Free
Half & Half
Ultra Pasteurized
Grade A

Is coffee associated with CVD?



Bioactives in Coffee

aliphatic acids

potassium

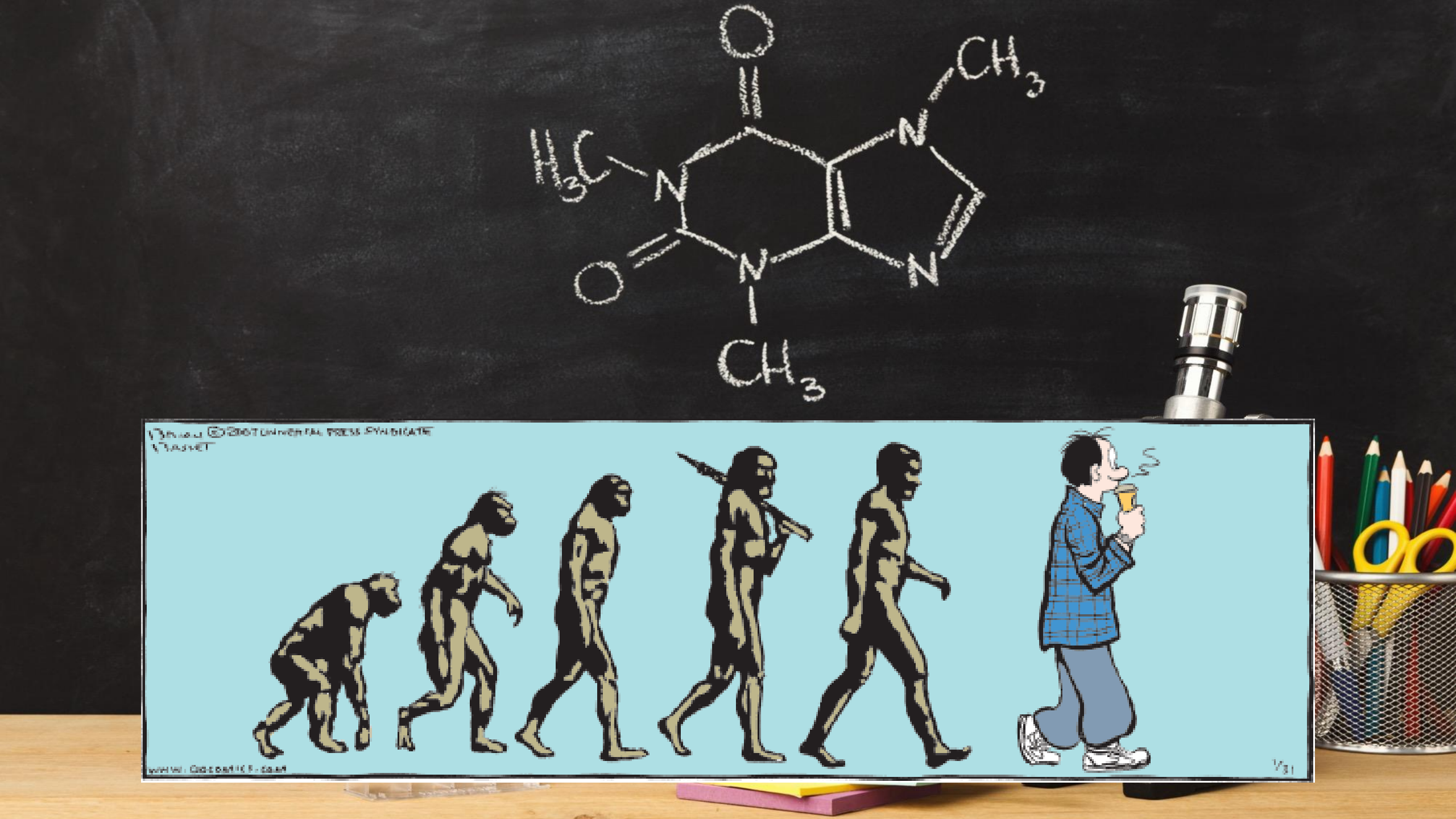
magnesium

melanoidins

diterpenoids

polyphenols

caffeine


O
CH3
H3C
N
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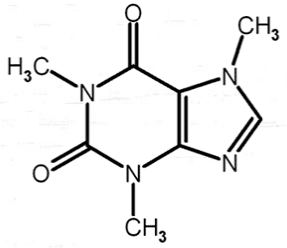
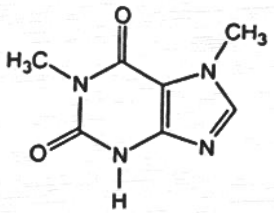
N
O
CH3

Caffeine



CYP1A2



Paraxanthine

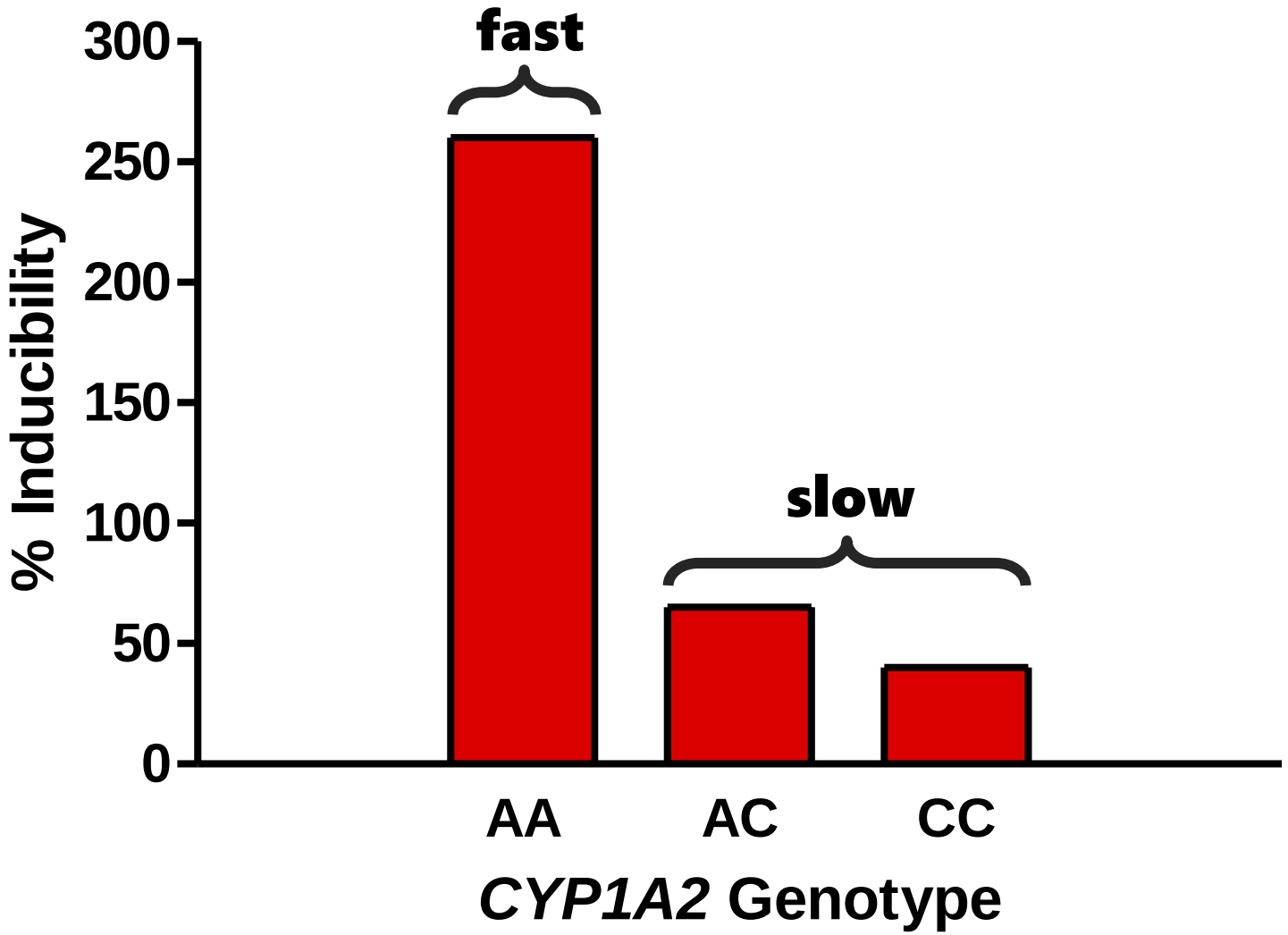
1,7-dimethyluric acid

1-methylxanthine

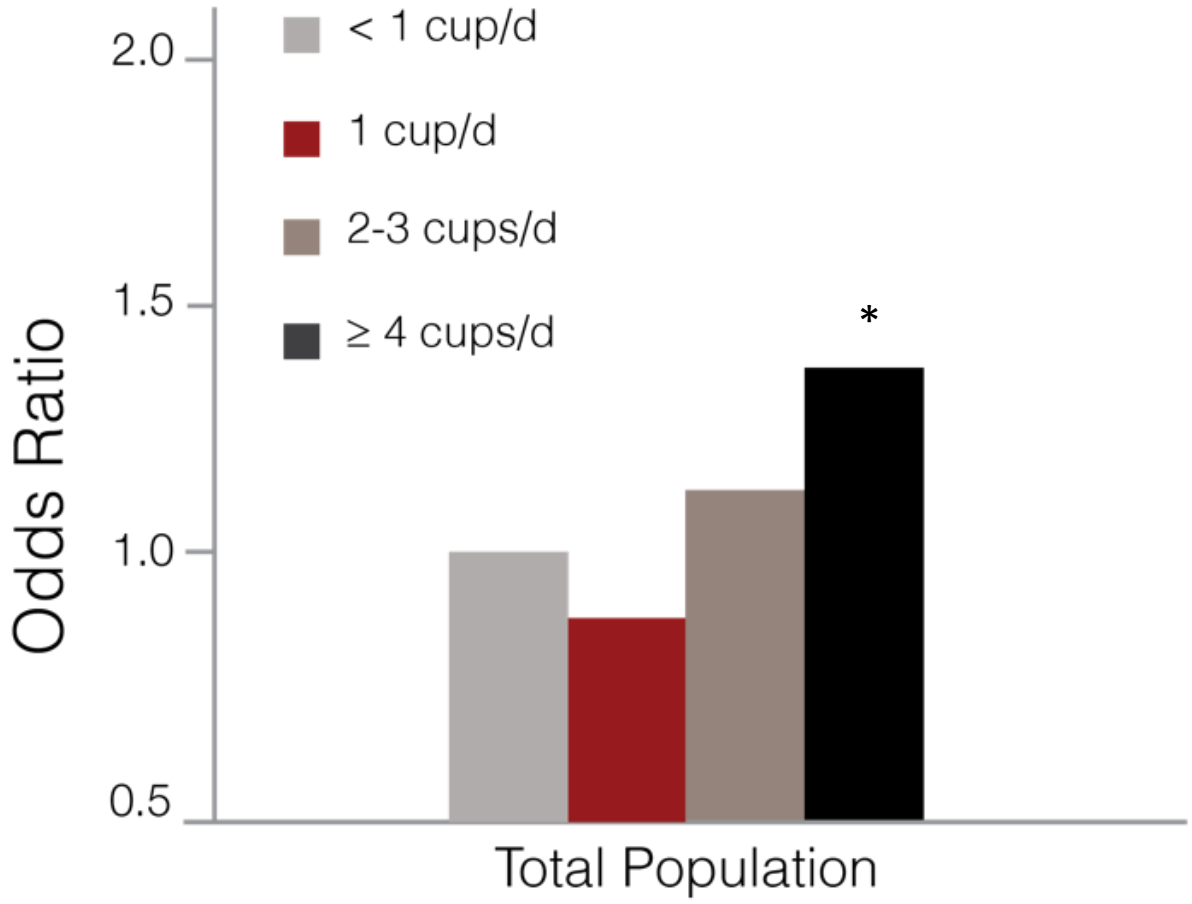
1-methyluric acid

5-acetylamino-6-formylamino-3-methyluracil

Genetic Variation in CYP1A2 (rs762551)



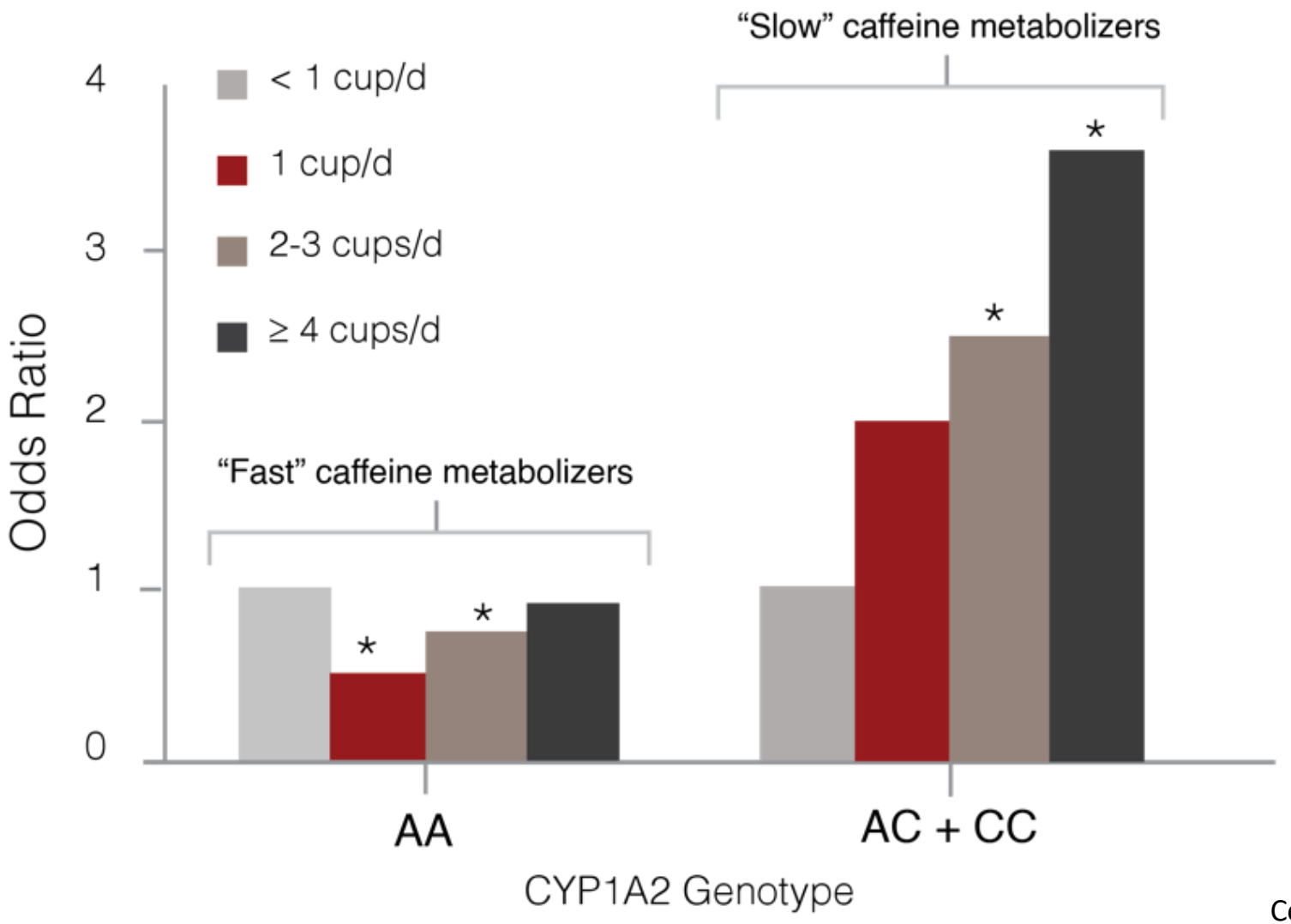
Coffee Intake & Risk of Myocardial Infarction



* P<0.05

Cornelis et al. JAMA. 2006;295:1135-41.

Coffee Intake, *CYP1A2* & Risk of Myocardial Infarction



Cornelis et al. JAMA. 2006;295:1135-41.

Coffee, CYP1A2 Genotype, and Risk of Myocardial Infarction

Marilyn C. Cornelis, BSc; Ahmed El-Sohemy, PhD; Edmond K. Kabagambe, PhD; et al

Article Information

JAMA. 2006;295(10):1135-1141. doi:10.1001/jama.295.10.1135

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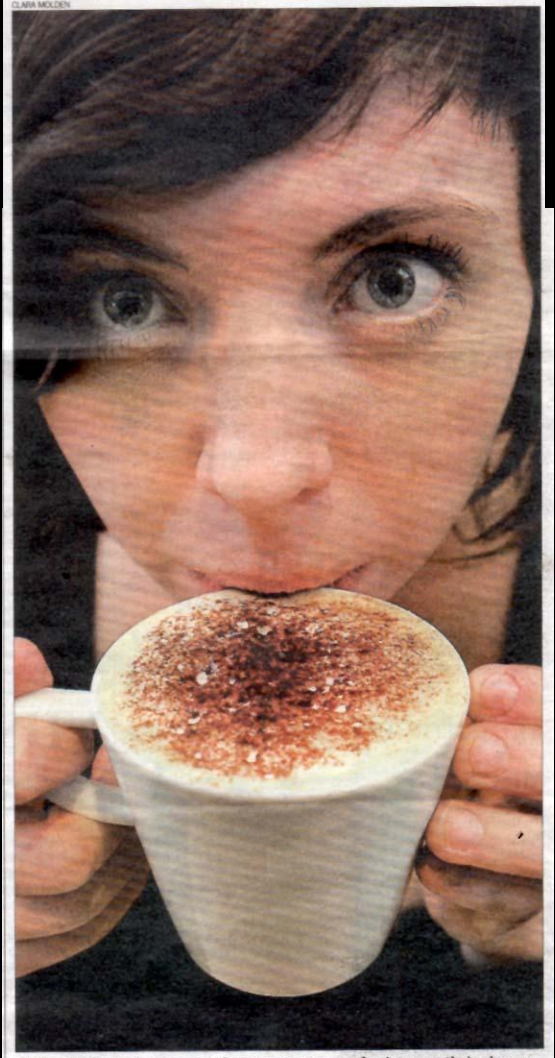
The Journal of the American Medical Association

THE TIMES 60p

No. 68643 ■ WEDNESDAY MARCH 8 2006 ■ NEWSPAPER OF THE YEAR

Why two cups of coffee can damage your heart

CLARA MOLDEN



Coffee drinkers who consume four or more cups a day increase their chances of having a heart attack by more than 60 per cent if they carry a variant gene, newly published research suggests. The risk for those who drink two to three cups a day was shown to be 36 per cent higher than normal NEWS page 11

THE TIMES 60p

No. 68643 ■ WEDNESDAY MARCH 8 2006 ■ NEWSPAPER OF THE YEAR

Gene that could make your next coffee your last

New research suggests that some people cannot process caffeine as quickly as others and may therefore be more vulnerable to a heart attack, **Sam Lister** reports

HELEN ATKINSON

High amounts of caffeine can be dangerous, but some doctors suggest coffee also has benefits

COFFEE drinkers who have more than three cups a day could significantly increase their chances of suffering a heart attack.

New research suggests that people who carry a particular variation of a gene cannot process caffeine as quickly as other people. Such individuals could be up to 64 per cent more likely to have a heart attack if they drink large amounts of coffee.

long be a source of controversy, with high amounts of caffeine long blamed for over-stimulating the nervous system. It contains ditrepenes, said to be responsible for raising levels of a stress hormone called homocystine, which can lead to strokes.

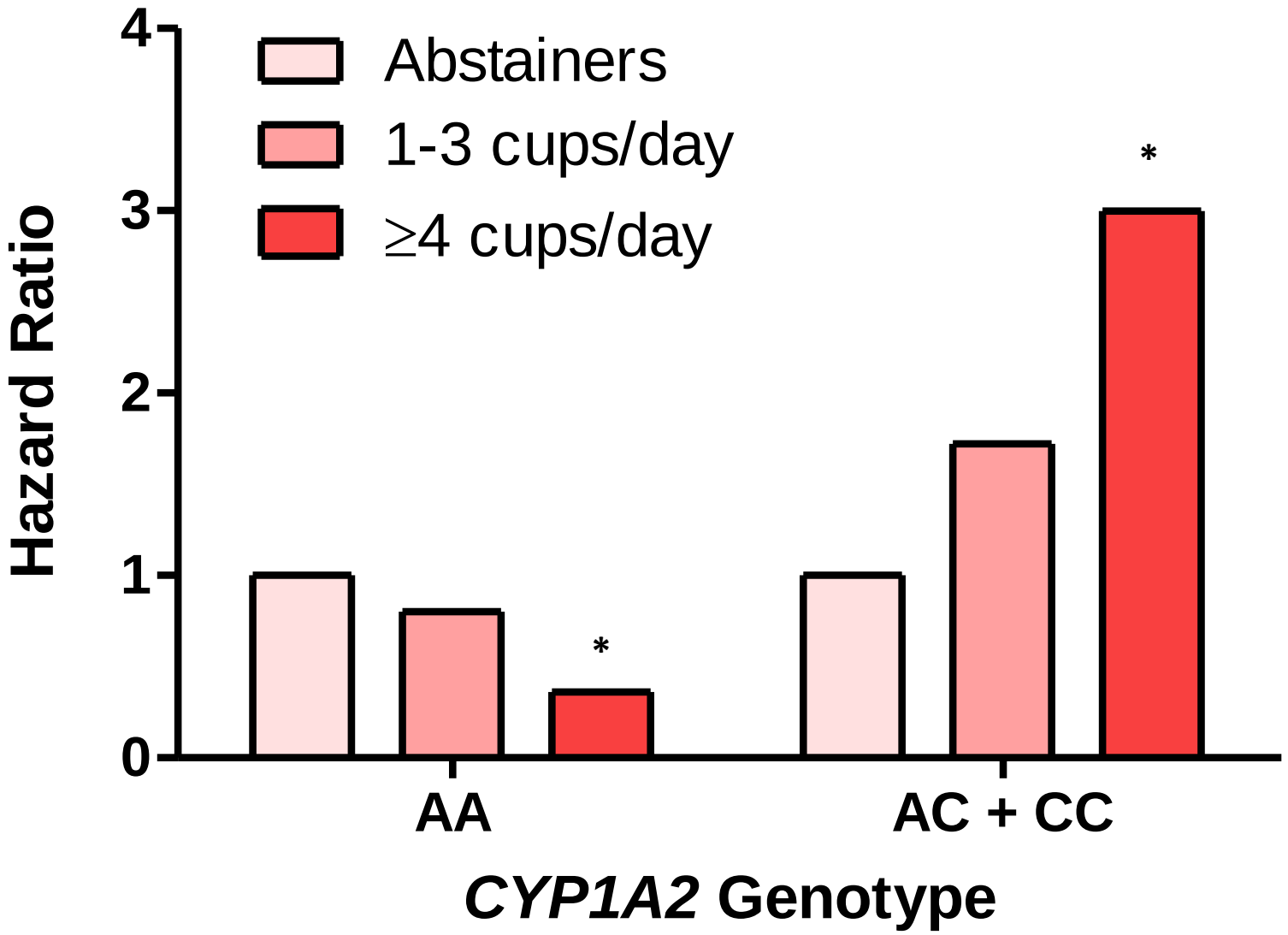
Pregnant women have been urged not to drink more than three cups of coffee a day in case it increases the chances of

Replication: Risk of Hypertension

CYP1A2 genotype modifies the association between coffee intake and the risk of hypertension

Paolo Palatini[a], Giulio Ceolotto[a], Fabio Ragazzo[a], Francesca Dorigatti[a], Francesca Saladini[a], Italia Papparella[a], Lucio Mos[b], Giuseppe Zanata[c] and Massimo Santonastaso[d]

Palatini *et al*., J Hypertens 27: 1594-1601, 2009



Coffee Intake and Risk of Hypertension

Replication: Risk of Pre-Diabetes

Eur J Epidemiol (2015) 30:209–217
DOI 10.1007/s10654-015-9990-z

CARDIOVASCULAR DISEASE

Association of coffee consumption and CYP1A2 polymorphism with risk of impaired fasting glucose in hypertensive patients

Paolo Palatini · Elisabetta Benetti · Lucio Mos · Guido Garavelli · Adriano Mazzer · Susanna Cozzio · Claudio Fania · Edoardo Casiglia

TORONTO | News

Some coffee drinkers could face kidney dysfunction if they don't reduce caffeine, new U of T research finds

Drinking 3 Or More Cups of Coffee a Day May Increase Kidney Dysfunction Risk, Study Finds

Experts explain the new research which could affect half of the population.

By Madeleine Haase Feb 20, 2023

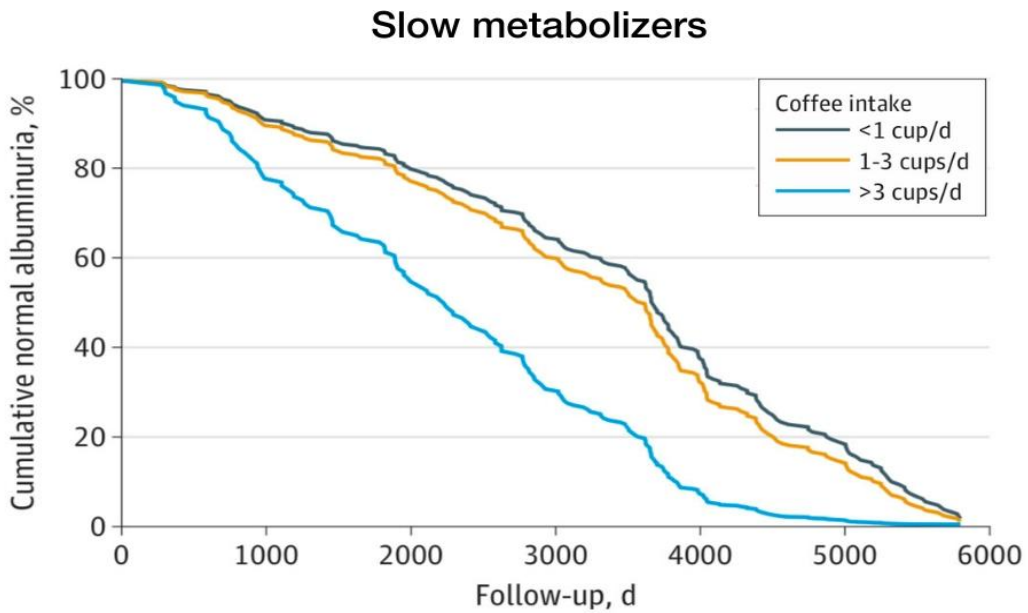
- *New research shows that some people may be at higher risk of kidney dysfunction when consuming too much coffee*

JAMA Network Open™

Original Investigation | Nephrology

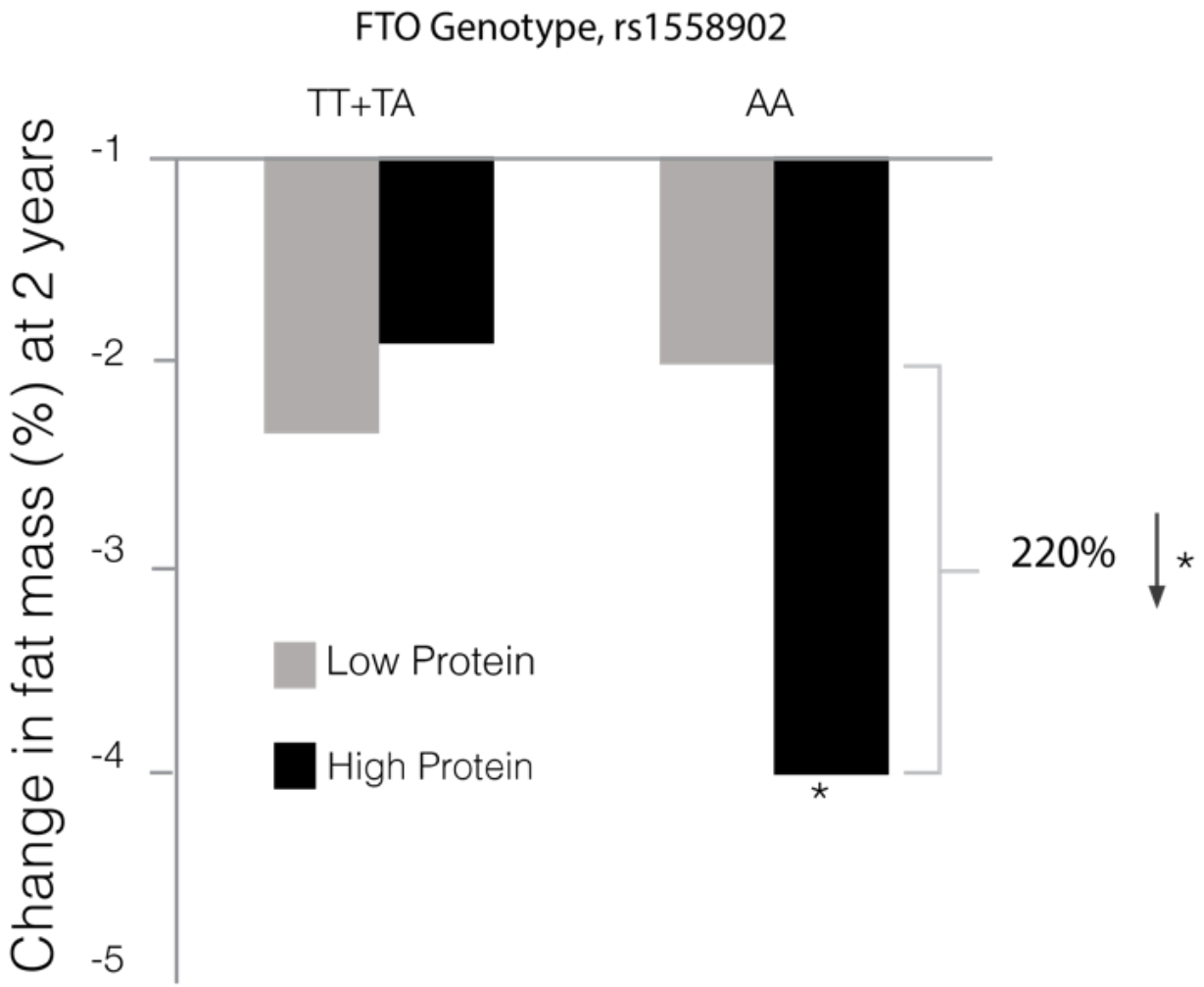
CYP1A2 Genetic Variation, Coffee Intake, and Kidney Dysfunction

Sara Mahdavi, PhD; Paolo Palatini, MD; Ahmed El-Sohemy, PhD



Weight Management

FTO, Protein & Weight Loss



Loss of fat mass after 2 years of low or high protein diet

Zhang et al. Diabetes. 2012;61:3005-3011.

Vitamin D and PMS

ELSEVIER

Journal of the Academy of Nutrition and Dietetics

Volume 119, Issue 1, January 2019, Pages 115-123

Research

Original Research: Brief

Association between Vitamin D Status and Premenstrual Symptoms

Alicia C. Jarosz MSc, Ahmed El-Sohemy PhD

Vitamin D, VDR Genotype and PMS

Jarosz *et al. Genes & Nutrition* (2021) 16:15
https://doi.org/10.1186/s12263-021-00696-2

Genes & Nutrition

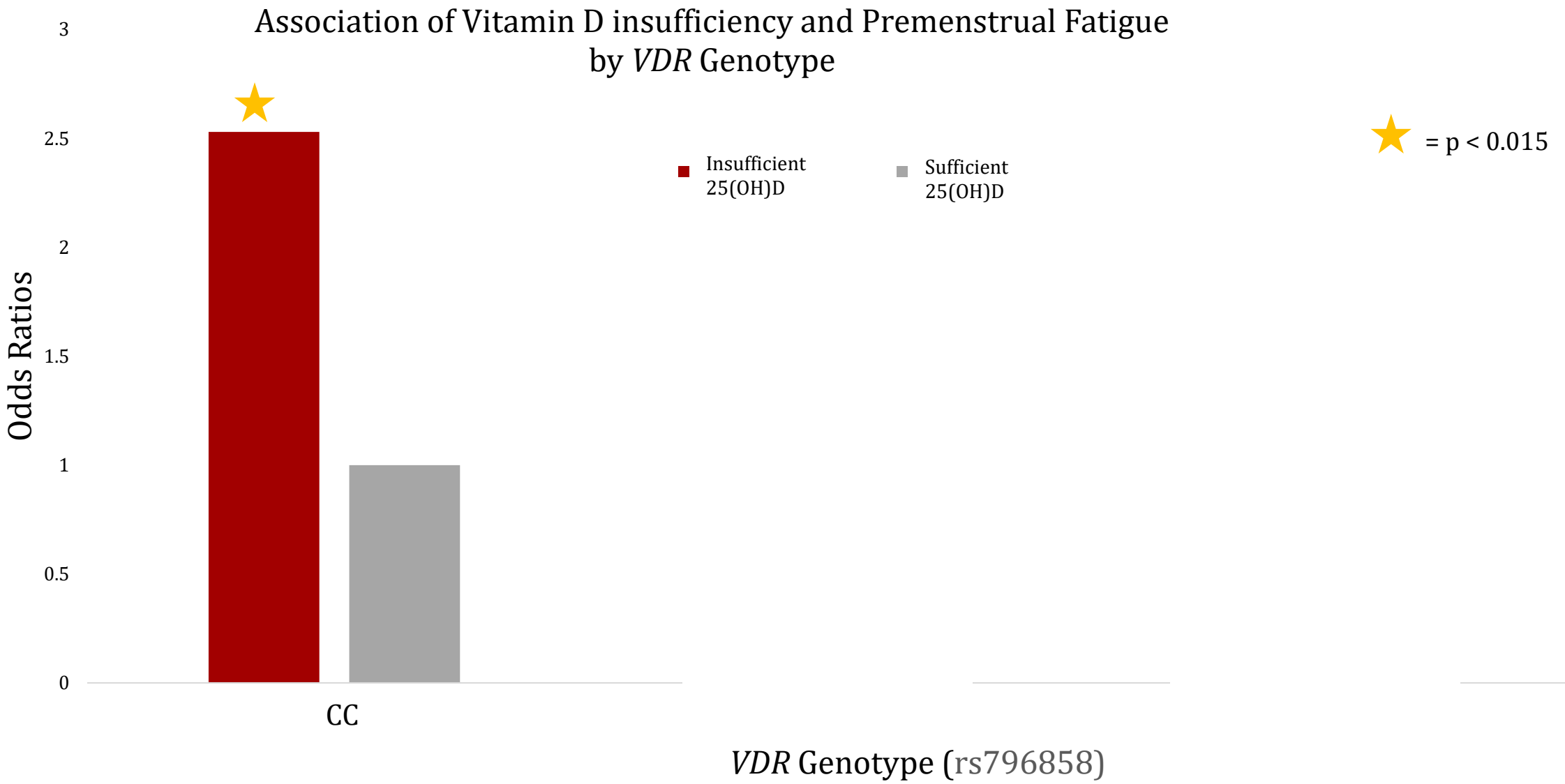
RESEARCH Open Access

Variation in the vitamin D receptor gene, plasma 25-hydroxyvitamin D, and risk of premenstrual symptoms

Alicia C. Jarosz†, Daniel Noori†, Tara Zeitoun, Bibiana Garcia-Bailo and Ahmed El-Sohemy*

Jarosz et al 2021 Genes & Nutrition

Vitamin D and PMS



Jarosz et al 2021 Genes & Nutrition

quora.com/Why-does-taking-vitamin-D-tablets-make-me-incredibly-tired

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Why does taking vitamin D tablets make me incredibly tired?

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There could be several reasons why taking vitamin D supplements makes you feel tired. One possibility is that the dose of vitamin D you are taking is too high for your body,

Continue reading

Mehile Orloff
2y

Some researcher NEEDS to do a study on this. I never realized there were so many people who had the same reaction to vitamin D.

My reactions are all typical, but my wife experiences exactly what you are talking about. And definitely not placebo. I brought home a a complex which she started taking without knowing that it had vitamin D in it. She felt the sleepiness kick in on the first day. And, this isn't just drowsiness that we're talking about. This is "pull off to the side of the road so that you don't crash and die" sleepiness.

80 2 11

Related questions

More answers below

Why would Vitamin D cause daytime sleepiness and tiredness?

Why am I constantly tired? I take iron and vitamin D tablets, but they are not working. Why could this be?

Can vitamin D (D3) cause lethargy or fatigue at doses between 2000 and 5000 IU prn in an adult?

Related questions

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Does taking vitamin D make a person tired?

I stopped taking my Vitamin D tablets a week ago and now I'm constantly exhausted and...

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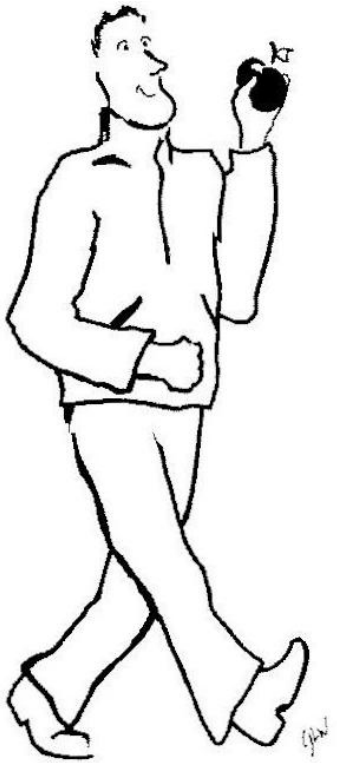
Does genetic information influence behavior?

I have the gene,
so I eat healthily.



I have the gene,
so what can I do?

Does genetic information influence behaviour?

DNA-based dietary advice resulted in:

- ✓ Greater understanding of recommendations
- ✓ Greater interest in learning more
- ✓ Greater motivation to change eating habits
- ✓ Greater compliance after 1 year

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

PLOS ONE

Disclosure of Genetic Information and Change in Dietary Intake: A Randomized Controlled Trial

Daiva E. Nielsen, Ahmed El-Sohemy

Published: November 14, 2014 • https://doi.org/10.1371/journal.pone.0112665

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Study Suggests Genetic Information May Lead to Behavioral Changes for Individuals with Sodium Sensitivity

Nov 14, 2014 | a GenomeWeb staff reporter

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Genetic testing for personalized nutrition leads to better outcomes

18/11/2014 08:50:00

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DNA-Testing to Tailor Diets can be Effective, Study Reports

Effects of Personalized Nutrition on Body Weight? – August 2020

Original Article
CLINICAL TRIALS AND INVESTIGATIONS

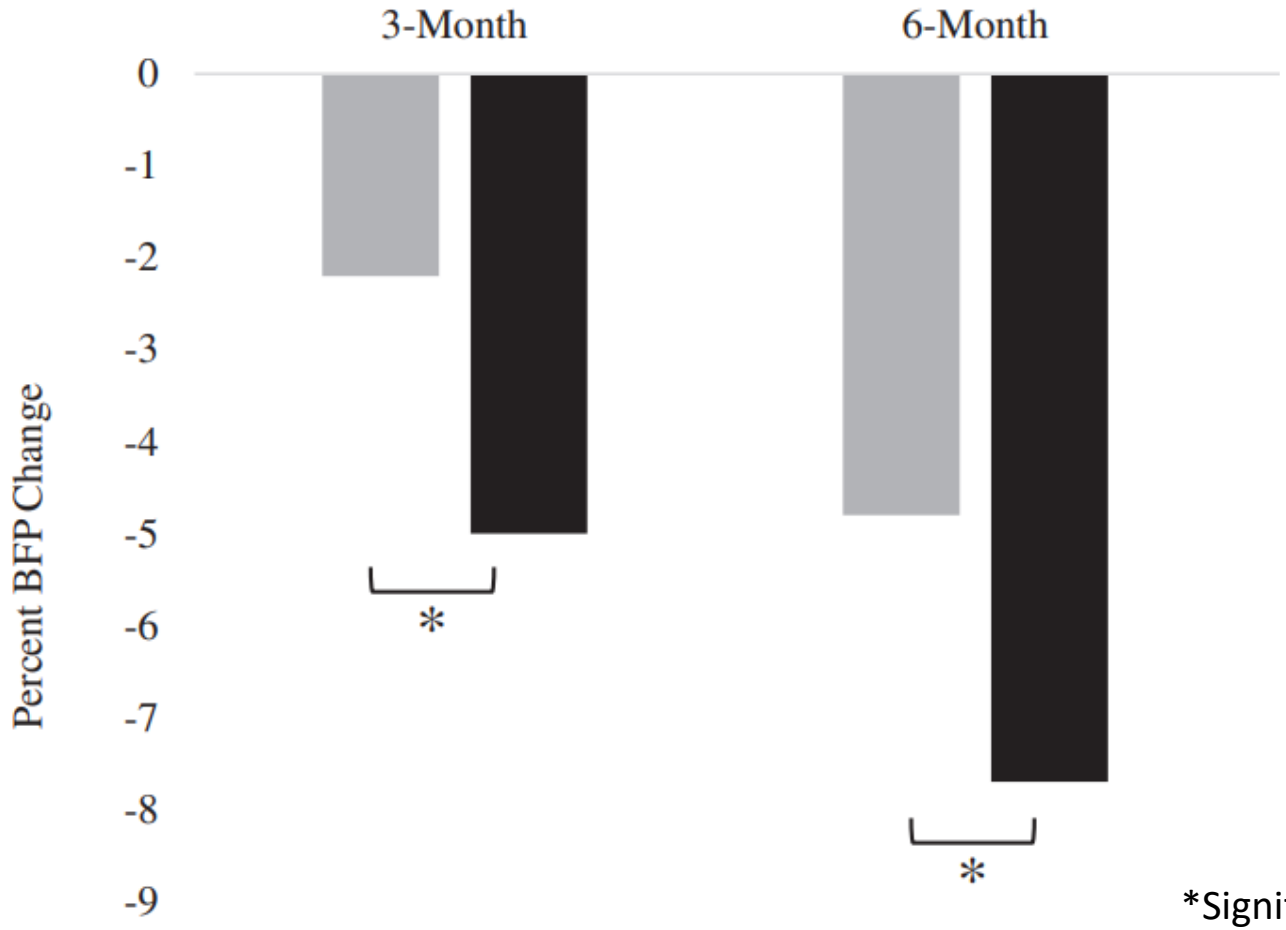
Obesity

Change in Weight, BMI, and Body Composition in a Population-Based Intervention Versus Genetic-Based Intervention: The NOW Trial

Justine R. Horne[1,2,3], Jason A. Gilliland[3,4,5,6,7,8,9], Colleen P. O'Connor[3,7,10], Jamie A. Seabrook[3,5,7,8,9,10], and Janet Madill[3,7,10]

 Received: 22 February 2020; **Accepted:** 30 April 2020; **Published online 22 July 2020. doi:10.1002/oby.22880**

Relative Change in Body Fat Percentage



DPP

DPP + Nutrigenomix

p-interaction = 0.003

*Significant difference between groups ($p<0.05$)

Adapted from Horne et al, Obesity 2020

Personalized advice elicited greater fat loss up to 6 months

Benefits of Genetic Testing

- ✓ Improved nutritional status
- ✓ Greater weight loss
- ✓ Improved compliance
- ✓ Enhanced motivation
- ✓ Better understanding of dietary advice
- ✓ Savings in healthcare expenditure

Common Questions

- Which practitioner should offer a nutrigenetics test?
- Are the test results diagnostic?
- How is the patient’s personal information protected?
- Is testing suitable for children?
- Will insurance cover the cost of the test?
- Who is a good candidate for a nutrigenetics test?

480BC

genotype

"Positive health requires a knowledge of man's **primary constitution** and of the powers of various foods, both those natural to them and those resulting from **human skill**."

Personalized nutrition

Hippocrates

2017

THE WALL STREET JOURNAL.

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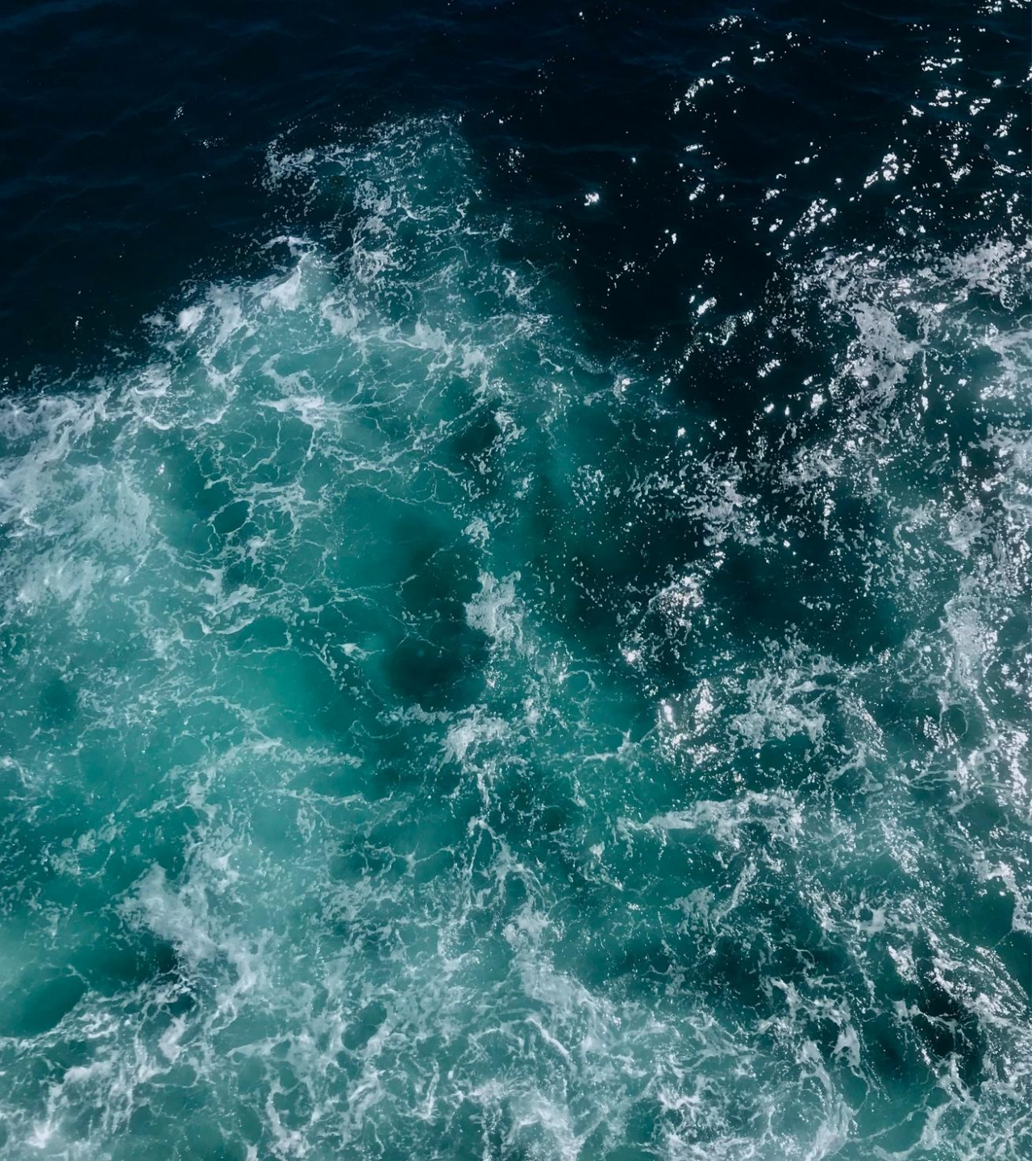
Test Your Genes to Find Your Best Diet

Genetic testing can reveal what nutrients you're missing and if you're drinking too much coffee



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